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Editorial

Selected Papers from the International Mixed Signals Testing and GHz/Gbps Test Workshop

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This special issue of the VLSI Design journal is dedicated to the 13th IEEE International Mixed Signals Testing Workshop (IMSTW) and 3rd IEEE International GHz/Gbps Test Workshop (GTW), held in June 2007 at Póvoa de Varzim, Portugal.

For the first time these two workshops were joined together in a single event dedicated to all aspects of testing, design for testability and reliable design of integrated mixed signals/technologies, functions, and systems. These include testing, design verification, and design for manufacturability of monolithic mixed signals/technologies systems-on-chip, circuits running in the multi-GHz clock range and/or including I/O capable of multi-Gbps data rates, and heterogeneous systems including system-in-package and printed circuit board implementations. The technology spectrum included analogue, mixed signals, high-speed input/output, radio-frequency (RF), micro-electro-optical-mechanical systems (MEOMSs), and nanotechnology.

This special issue comprises the most outstanding contributions selected from the best papers presented at this joint event, after having undergone an additional reviewing process, and constitutes a display of advanced research focusing on challenges and solutions associated with domains in the forefront of complex chip design. The selected nine papers address the test and characterization of A/D converters (ADC), fault modeling, simulation, and diagnosis of analog circuits, builtin calibration and diagnosis of RF transmitters, and test of MEOMS devices.

The paper from Vincent Kerzérho et al. presents a technique which allows the dynamic testing of ADC for harmonic distortion using waveform generators with the same resolution as the ADC under test. Another issue with ADC testing concerns the complexity of data processing. A new algorithm for estimating ADCs' nonlinearity is proposed by E. J. Peralías et al., which is based on the spectral processing of the ADC output to estimate its harmonic amplitudes and phase-shifts from which the INL signature is derived, as an alternative to resorting to the time-consuming code histogram test.

Every millisecond cut in testing time can save millions of dollars in a production run. That can be achieved after finding the proper set of tests. With the "Choice of a High-Level Fault Model for the Optimization of Validation Test Set Reused for Manufacturing Test," as presented by Y. Joannon et al., the number and efficiency of test stimuli can be optimized. Fault modeling and simulation is also crucial for diagnosis purposes. Augusto and Almeida present "A Tool for Single-Fault Diagnosis in Linear Analog Circuits with Tolerance Using the T-vector Approach" which accounts for tolerances in components' values.

High frequencies in the gigahertz range together with the use of diverse digital modulation methods such as binary phase-shift keying (BPSK) and quadrature (QPSK) phase-shift keying, code division multiple access (CDMA), and orthogonal frequency division multiplexing (OFDM), complicate the testing of RF transceivers. V. Natarajan et al. show how built-in testing features can be used to help diagnosing and calibrating functional parameters.

A method for diagnosing capacitive MEMS accelerometers is proposed by L. A. Rocha et al. which allows

estimating overetching, mismatch, and Young's modulus parameters relying on the measurement of pull-in voltages and resonance frequency.

The advances in MEMS technology allow the development of devices for RF applications, namely as switches. RF MEMS-based switches are characterized (compared namely with FET's and PIN diodes) by presenting low insertion loss, power consumption, fabrication cost, and intermodulation, further with high isolation (tens of GHz). The paper presented by E. Simeu et al. describes a new method to test RF MEMS which allows extracting the high-frequency characteristics of the switch from the envelope of its response to a low-frequency actuation test stimulus.

MEMS switches are also good candidates to be used as builtin test circuitry. The loopback testing of multigigahertz devices can be enhanced by using MEMs switches, taking advantage of their higher bandwidth and smaller size compared to traditional relays, and SiGe logic to configure a variety of active loopback structures, as it is shown by D. C. Keezer et al.

MEMS devices have been also developed for biochemical and microfluidics applications, namely on droplet-based peptide synthesizers for initial diagnosis of cancer or virus. H. G. Kerkhof et al. address the reliability of these diagnoses with a technique to detect droplet presence or purity problems via current or impedance measurements using electrodes near the peptide collector area.

On behalf of the journal, we would like to conclude this Editorial to thank our former Chief Editor, Dr. Bernard Courtois for his support in the publication of this Special Issue. We would also like to take this opportunity to thank the help and advice of various reviewers. They read the manuscript submissions, provided invaluable feedback to the authors, and shared their professional wisdom and insight.

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